Diapycnal Mixing in the Strait of Hormuz

Hartmut Peters
Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami, Fl 33149-1098
Phone: (305) 361-4032. Fax: (305) 361-4696. hpeters@rsmas.miami.edu

Grant number N00014140-011-0021
http://www.rsmas.miami.edu/divs/mpo/people/hpeters.html

LONG-TERM GOALS

The long-term scientific goal of my research is to observe, understand and model smallscale turbulent mixing and to relate it to the mesoscale and largescale flow in which the turbulence is embedded. My effort is focused on coastal and marginal seas.

OBJECTIVES

The objectives of the project are to

- observe turbulent mixing in the Strait of Hormuz as an example of a wide and shallow passage where rotation, friction and non-stationarity are likely important,
- to relate the turbulence to its generating mechanisms, and
- to obtain a first estimate of the role and importance of smallscale vertical mixing within the flow regime.

APPROACH

During a 12-day cruise, planned observations focus on the vicinity of Cape Musandam in the Strait of Hormuz, where highly variable bathymetry and channel curvature indicate a potential for enhanced mixing. Measurements are shipboard only, employing a 300-kHz acoustic Doppler current profiler (ADCP) and a small OS500 conductivity –temperature-depth probe (CTD) with added temperature microstructure capability. Turbulence can be assessed through a combination of observing overturning scales and thermal dissipation rates.

WORK COMPLETED

In order to allow for the necessary preparations and for other commitments (see below), the cruise was planned for the winter season of 2001/2002. Cruise preparations have been focused on the instrumentation (OS500 CTD and shipboard ADCP) and on the logistics of chartering a ship out of Dubai, United Arab Emirates. In response to the current political situation after the terrorist attack on New York City and Washington, and after an armed attack on the R/V Maurice Ewing off the coast of Somalia during the recent Redsox-2 cruise, I am currently in the process of assessing possible risks for the safety of the personnel involved in the planned cruise in the Strait of Hormuz.

Planning for the deployment of a 300-kHz Workhorse ADCP over the side of a charter vessel was carried out based on experience gained during work with small vessels off south Florida and in the Hudson River. The response of the OS500 CTD to a sharp step in temperature (T) and electrical conductivity (C) was measured in a tank of Dr. Ray Schmitt at Woods Hole Oceanographic. The tank employs double diffusion between cold and fresh water on top and warm and salty water on the bottom to maintain an interface a few centimeters thick. Characteristic of the response of the regular CTD sensors of the OS500 to step changes in C and T are a maximum vertical resolution of approximately 0.5 m, slight oscillations in T, and poor response at fall velocities slower than about 0.5 m/s. Theses characteristics are probably due to a less than optimal flushing of the TC sensor assembly (the same as in the Ocean Sensors OS200 CTD). Consequently, the extraction of Thorpe scales will have to rely on the added fast FP07 thermistor which was as fast as expected.

RESULTS

New project.

IMPACT/APPLICATIONS

New project.

TRANSITIONS

New project.

RELATED PROJECTS

With support by the National Science Foundation, the outflow of salty and heavy water from the Red Sea into the Gulf of Aden has been examined in the Red Sea Outflow Experiment (REDSOX), W. Johns, H. Peters, A. Bower and D. Fratantoni, co-PIs. Two cruises in February/March 2001 on the R/V Knorr and in August/September 2001 on the R/V Maurice Ewing probed the 'near field' of the outflow between the Strait of Bab el Mandeb and the deep Tadjura Rift and the 'far field' in the western Gulf of Aden. Turbulence in the outflow plume was observed via Thorpe scales from CTD data and through measurements of the detailed boundary layer flow structure and of the Reynolds stress with a bottom-mounted ADCP.